San Francisco Bay Conservation and Development Commission
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TO: Bay Fill Working Group Committee Members

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SUBJECT: **Fresh Water Flow and Tidal Barriers Policy Background**
(For Bay Fill Work Group consideration on October 20, 2016)

BCDC Policies & Adaptive Management

The Bay Fill Working Group will receive a briefing on aspects of the use of tidal barriers, specifically tide gates on creeks as an adaption measure for rising sea level , which would be considered fill under the San Francisco Bay Plan policies. Mr. Roger Leventhal, currently with the Marin County Department of Public Works, Flood Protection Division will give a presentation on this topic. In preparation for this meeting and discussion, a few definitions of different tide and flood barriers are provided, as well as San Francisco Bay Plan policy excerpts that would likely be applicable to tide gates and other tidal barrier projects.

Definitions:

Dikes are structures put in place to isolate a creek or slough, preventing water flow.

Tide gates are structures placed generally across channels and creeks that allow tides to flow in one direction, but then shuts and does not allow water to flow in the opposite direction. Some are designed to be moderated according to need and management regimes.

A **flood wall** is a primarily vertical artificial barrier designed to temporarily contain the waters of a river or other waterway which may rise to unusual levels during seasonal or extreme weather events.

A **flood barrier**, **surge barrier** or **storm surge barrier** is a specific type of floodgate, designed to prevent a storm surge or spring tide from flooding the protected area behind the barrier. A surge barrier is almost always part of a larger flood protection system consisting of floodwalls, levees (also known as dikes), and other constructions and natural geographical features. Flood barrier may also refer to barriers placed around or at individual buildings to keep floodwaters from entering those buildings.

A **tidal barrage** is a dam-like structure used to capture the energy from masses of water moving in and out of a bay or river due to tidal forces. Instead of damming water on one side like a conventional dam, a tidal barrage first allows water to flow into a bay or river during high tide, and releasing the water back during low tide. This is accomplished by measuring the tidal flow

and controlling the sluice gates at key times of the tidal cycle. Turbines are then placed at these sluices to capture the energy as the water flows in and out.

Questions for the work group to consider:

1. How would tide gates be tied into adjacent lands, and would they require additional flood protection via walls or levees if not currently in place?
2. Would tide gates cause increased flooding and water retention time on either side of the gate and therefore have adverse impacts? For example, Is there capacity within the stream to accommodate precipitation during storms
3. How would sediment and nutrient flow be impacted by tide gates and how would this affect the upstream and downstream tidal marsh?
4. How would water quality be impacted by tide gates (i.e., temperature, salinity, pollutants, suspended sediment)?
5. As sea level rises, how frequently would the tide gates need to be closed, and how would the structure be adapted overtime increased water levels?

San Francisco Bay Plan Policies

Fish, Other Aquatic Organisms and Wildlife

1. To assure the benefits of fish, other aquatic organisms and wildlife for future generations, to the greatest extent feasible, the Bay's tidal marshes, tidal flats, and subtidal habitat should be conserved, restored and increased.

Water Quality

1. Bay water pollution should be prevented to the greatest extent feasible. The Bay's tidal marshes, tidal flats, and water surface area and volume should be conserved and, whenever possible, restored and increased to protect and improve water quality. Fresh water inflow into the Bay should be maintained at a level adequate to protect Bay resources and beneficial uses.
2. Water quality in all parts of the Bay should be maintained at a level that will support and promote the beneficial uses of the Bay as identified in the San Francisco Bay Regional Water Quality Control Board's Water Quality Control Plan, San Francisco Bay Basin [Plan] and should be protected from all harmful or potentially harmful pollutants. The policies, recommendations, decisions, advice and authority of the State Water Resources Control Board and the Regional Board should be the basis for carrying out the Commission's water quality responsibilities.

Surface Area and Volume

1. The surface area of the Bay and the total volume of water should be kept as large as possible in order to maximize active oxygen interchange, vigorous circulation, and effective tidal action. Filling and diking that reduce surface area and water volume should therefore be allowed only for purposes providing substantial public benefits and only if there is no reasonable alternative.
2. Water circulation in the Bay should be maintained, and improved as much as possible. Any proposed fills, dikes, or piers should be thoroughly evaluated to determine their effects upon water circulation and then modified as necessary to improve circulation or at least to minimize any harmful effects.
3. Because further study is needed before any barrier proposal to improve water circulation can be considered acceptable, the Bay Plan does not include any barriers. Before any proposal for a barrier is adopted in the future, the Commission will be required to replan all of the affected shoreline and water area.

Tidal Marshes and Tidal Flats

1. Tidal marshes and tidal flats should be conserved to the fullest possible extent. Filling, diking, and dredging projects that would substantially harm tidal marshes or tidal flats should be allowed only for purposes that provide substantial public benefits and only if there is no feasible alternative.
2. Any proposed filling, diking, or dredging project should be thoroughly evaluated to determine the effect of the project on tidal marshes and tidal flats, and designed to minimize, and if feasible, avoid any harmful effects.
3. Projects should be sited and designed to avoid, or if avoidance is infeasible, minimize adverse impacts on any transition zone present between tidal and upland habitats. Where a transition zone does not exist and it is feasible and ecologically appropriate, shoreline projects should be designed to provide a transition zone between tidal and upland habitats.
4. Where feasible, former tidal marshes and tidal flats that have been diked from the Bay should be restored to tidal action in order to replace lost historic wetlands or should be managed to provide important Bay habitat functions, such as resting, foraging and breeding habitat for fish, other aquatic organisms and wildlife. As recommended in the Baylands Ecosystem Habitat Goals report, around 65,000 acres of areas diked from the Bay should be restored to tidal action to maintain a healthy Bay ecosystem on a regional scale. Regional ecosystem targets should be updated periodically to guide conservation, restoration, and management efforts that result in a Bay ecosystem resilient to climate change and sea level rise. Further, local government land use and tax policies should not lead to the conversion of

these restorable lands to uses that would preclude or deter potential restoration. The public should make every effort to acquire these lands for the purpose of habitat restoration and wetland migration.

5. The Commission should support comprehensive Bay sediment research and monitoring to understand sediment processes necessary to sustain and restore wetlands. Monitoring methods should be updated periodically based on current scientific information.

Fresh Water Inflows

1. Diversions of fresh water should not reduce the inflow into the Bay to the point of damaging the oxygen content of the Bay, the flushing of the Bay, or the ability of the Bay to support existing wildlife.

3. The impact of diversions of fresh water inflow into the Bay should be monitored by the State Water Resources Control Board, which should set standards to restore historical levels (1922-1967) of fish and wildlife resources. The Bay Commission should cooperate with the State Board and others to ensure that adequate fresh water inflows to protect the Bay are made available.

Climate Change

1. To address the regional adverse impacts of climate change, undeveloped areas that are both vulnerable to future flooding and currently sustain significant habitats or species, or possess conditions that make the areas especially suitable for ecosystem enhancement, should be given special consideration for preservation and habitat enhancement and should be encouraged to be used for those purposes.

Safety of Fill

4. Adequate measures should be provided to prevent damage from sea level rise and storm activity that may occur on fill or near the shoreline over the expected life of a project. The Commission may approve fill that is needed to provide flood protection for existing projects and uses. New projects on fill or near the shoreline should either be set back from the edge of the shore so that the project will not be subject to dynamic wave energy, be built so the bottom floor level of structures will be above a 100-year flood elevation that takes future sea level rise into account for the expected life of the project, be specifically designed to tolerate periodic flooding, or employ other effective means of addressing the impacts of future sea level rise and storm activity. Rights-of-way for levees or other structures protecting inland areas from tidal flooding should be sufficiently wide on the upland side to allow for future levee widening to support additional levee height so that no fill for levee widening is placed in the Bay.

Mitigation

1. Projects should be designed to avoid adverse environmental impacts to Bay natural resources such as to water surface area, volume, or circulation and to plants, fish, other aquatic organisms and wildlife habitat, subtidal areas, or tidal marshes or tidal flats. Whenever adverse impacts cannot be avoided, they should be minimized to the greatest extent practicable. Finally, measures to compensate for unavoidable adverse impacts to the natural resources of the Bay should be required. Mitigation is not a substitute for meeting the other requirements of the McAteer-Petris Act.